Background

The Federal Emergency Management Agency, through agreements with the National Institute of Building Sciences, has developed a standardized, nationally applicable earthquake loss estimation methodology. This methodology is implemented through a PC-based Geographic Information System (GIS) software called HAZUS. Loss estimates calculated with HAZUS® are used by local, state, and regional officials for planning and stimulating mitigation efforts to reduce losses and preparing for emergency response before earthquakes occur, and in decision support following earthquakes. Additionally, the loss estimates are the basis for a nationwide assessment of earthquake risk that will provide a basis for allocating national resources for future disasters.

The development of HAZUS® is supported by FEMA's leadership role in developing a comprehensive national mitigation strategy that includes hazard identification and risk assessment for communities throughout the United States.

HAZUS® stands for HAZARDS U.S. The software utilizes GIS technology to produce detailed maps and analytical reports that describe a community's potential losses. Emergency managers from the 50 states and all U.S. Territories have been trained to use HAZUS®. HAZUS® has been sent to more than 1100 users including both public and private organizations. Private organizations include academics, engineering consultants and insurance industry professionals. Additionally, several foreign countries are using HAZUS® as a model for their own development of an earthquake loss estimation product.

Major initiatives using HAZUS® are underway in the New York Metropolitan Area, the San Francisco Bay Area, the California Office of Emergency Services, Portland, OR, and other cities. In addition, HAZUS® will be linked to the REDI-CUBE network of sensors in California. In an actual earthquake event, HAZUS® will automatically receive data on the location and size of an earthquake from the network and run an analysis based on that data. When implemented, these results will represent FEMA's first official estimates of damage and loss.

Wind and Flood Models

HAZUS® is being expanded into an integrated multihazard loss estimation program capable of performing loss estimations for floods, hurricanes, tornados, coastal storm surge, severe winter storms, thunderstorms, and hail in addition to earthquakes. FEMA and NIBS initiated development of the wind and flood models in 1997 with the creation of two committees to oversee technical development of the models.

The wind and flood models will allow practitioners to estimate economic and social losses from floods and extreme winds. The information provided by HAZUS® will assist state and local officials with planning for, and evaluating, the potential effects of mitigation on flooding and flood loss, and damage and loss from hurricanes and other extreme winds. The models will provide practitioners and policy makers a tool to help reduce disaster payments, and make wise use of the nation's floodplains.

Initial model development was completed in early 1999. For the flood model, this included an assessment of the state-of-the-art of flood loss estimation studies, data, and ongoing research, followed by testing the alternative flood loss estimation methodologies viewed as most promising. Alternative methodologies were tested in six communities having a variety of flooding conditions, recent experience with flooding, and good data sets and mapping. The most feasible alternative method was selected and is being further developed into the flood loss estimation methodology, The flood model is being developed by ABS Consulting of San Francisco, California, with Michael Baker, Inc. of Alexandria, Virginia.

On the wind side, the initial phase focused on one hazard (hurricanes) and included development of the physical damage and direct loss framework for buildings and facilities. A regional loss study that included computing direct losses and property damage for Dade, Broward, and Palm Beach counties in South Florida was also completed in the initial phase. This approach demonstrated the vision of the wind loss methodology for hurricanes and provided the needed first steps for its eventual full development and HAZUS® implementation. Additional work is being preformed to complete and finalize the hurricane hazard-damage-loss model. The wind model is being developed by Applied Research Associates of Raleigh, North Carolina.

In 2002, FEMA intends to release the HAZUS Flood Model and Preview Hurricane Model. The Flood Model will be capable of assessing riverine, coastal, and alluvial fan flooding. The Preview Hurricane Model will be limited to Atlantic and Gulf Coast hurricanes. The models will compute basic estimates of potential damage to residential, commercial, and industrial buildings, direct economic losses, and shelter requirements. Additionally, the InCAST inventory data collection tool will be released in 2002 with expanded capabilities for multihazard data collection in support of the 2002 releases.

HAZUS Earthquake

HAZUS® is a tool for collecting inventory data and making estimates of possible losses from earthquakes Major features are a substantial default inventory data base, census tract level of resolution, classification systems for buildings and lifelines, data on geology including the location and size of potential earthquake hazards, mathematical formulas for calculating damage and loss, and economic data. HAZUS® displays inventory, damage, and loss data in summary tables and full-color maps. The earthquake model was developed by Risk Management Solutions of Menlo Park, California, under the oversight of a committee of earthquake experts.

HAZUS® may be used at three levels of complexity:

- Level 1 uses HAZUS® default data to create rapid impressions of the type of damage that an earthquake scenario may produce. Default data, from national databases, describes the regional geology, building inventory, and economic structure of a community.
- Level 2 requires user-modified default data and user-supplied data to achieve more refined results. For estimates at this level, the user must provide detailed information about local geology, a detailed inventory of buildings in the community, and utility and transportation systems data.
- Level 3 uses expert-supplied techniques to study special conditions of study sites, such as potential dam break scenarios, exposure to tsunami, and network analysis for electrical lifelines. Geotechnical and engineering experts with the ability to input specialized software routines are needed at this level.

HAZUS® is available on CD-ROM and operates on a commercial GIS platform, either MapInfo or ArcView. HAZUS® includes a computer-based tutorial for demonstrating the software and an inventory collection and survey tool. Supplemental multihazard databases for each state are also available on separate CD-ROMs. A user's manual describes how to perform loss estimates, and a three volume technical manual describes the technical and engineering theory of the methodology. Both are downloadable from the FEMA HAZUS® website at www.fema.gov/hazus. HAZUS users are provided free technical support through a toll free 800 number.